pressure continued high and the cloudiness increased seems to indicate that this northwest wind was only local and temporary. In the latter case the low area must have filled in completely, or have moved rapidly to the east or southeast beyond the area of observations.

On the afternoon of July 16, rain began to fall at Rio, presumably with a return of the wind to the south and a continued rise in pressure as the auticyclone moved eastward.

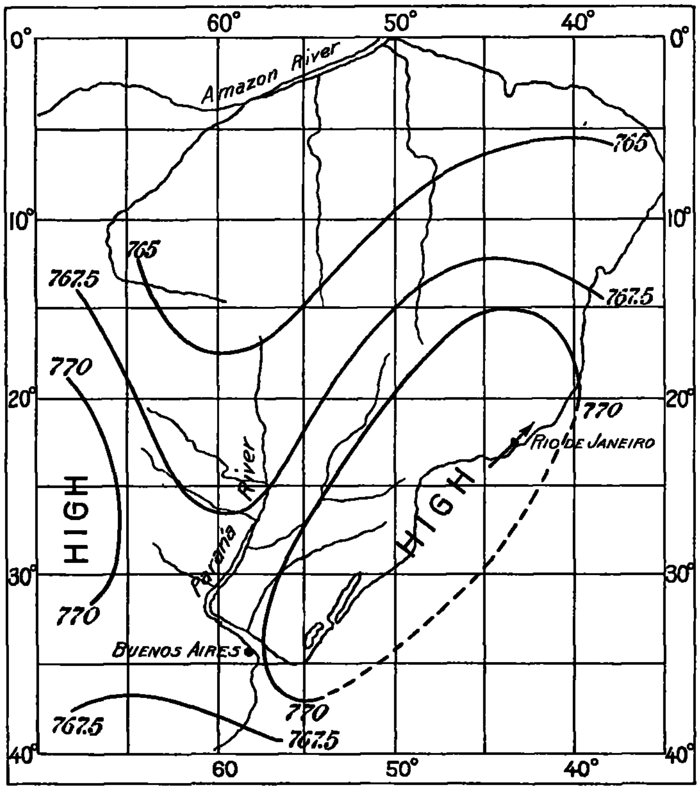

FIG. 7.—Weather Map of South America, July 19, 1908, 8 a. m., Cordoba time.

The weather maps for July 17 and 18 (see figs. 5 and 6), show that the high-pressure area advanced steadily toward the coast, but that on the morning of the 18th it changed the direction of its advance to northeastward and followed along the coast until July 20. As the center of the high area approached the rain at Rio ceased and the sky began to clear. On the 20th the center of the anticyclone was located slightly to the south and west of Rio de Janeiro (see fig. 8), and a new low pressure had developed in central Argentina.

Thus the only influence that Professor Ward's "weak cyclonic area" had on the rain of July 16 to 18 at Rio de Janeiro seems to have been to delay its start by holding the winds in the northern quadrant for from twelve to twenty-four hours longer than they would otherwise have remained there. Furthermore, the rain which would naturally have resulted at Rio from the passage of a well-developed storm on July 13 was averted by the presence of a weak anticyclone in northern Brazil.

It is proper to here draw attention to the fact that a very large percentage of the rainfall in eastern South America occurs with a rising barometer and southerly winds whether this condition be produced by the recession of a low pressure or the advance of a high pressure. The rainfall is greatest when a low center is closely followed by a high.

It is true that the changes in pressure and temperature are but slight in northern Brazil, but they form a useful index to the probable course of atmospheric disturbances in higher latitudes and they should by no means be discarded. It should also be remarked that the criticisms directed against the Brazilian Meteorological Service, e. g., failure of telegraphic reports to arive on time, insufficient number of observing stations, the limited nature of the forecasts, etc., are simply those which would apply to any young service in a sparsely populated territory and will undoubtedly disappear in time. There are, however, one or two defects in the Brazilian system apparently not associated with the growth of the service.

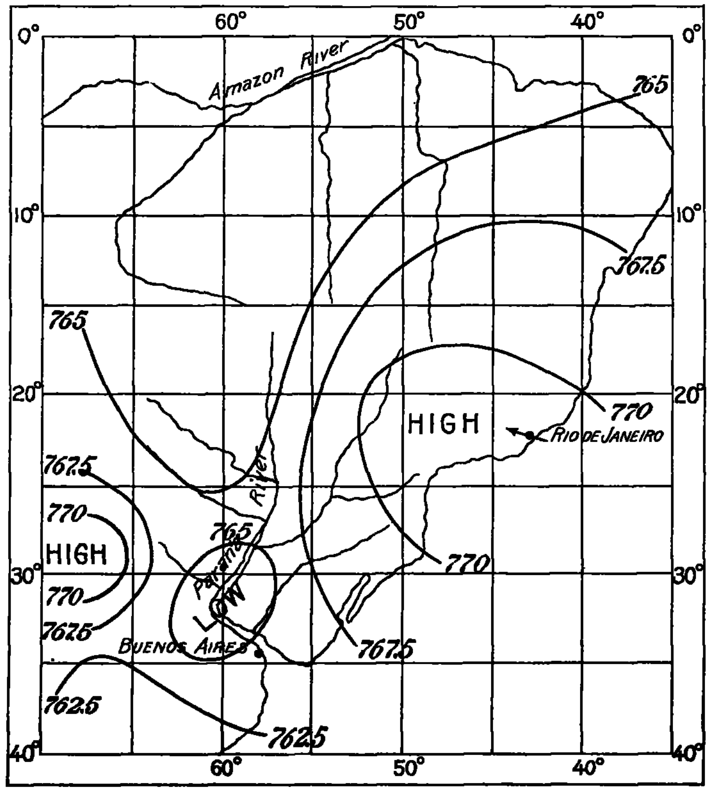

FIG. 8.—Weather map af South America, July 20, 1908, 8 a. m., Cordoba time.

These are the partition of the work among different government departmeuts, the lack of effective cooperation between the national service and those of the individual States, and finally, the adherance to station pressures, instrumental constants and reduction tables which combine to give the isobars of the map weird contours dissimilar to anything observed in other countries, with barometric gradients out of all proportion to the observed wind velocities.

In conclusion, I would call attention to the fact that since the middle of November, 1908, the Brazilian Daily Bulletin has been substantially improved. It is now printed from type, includes the wind and cloud data and special comments opposite each station, and the map is reserved exclusively for the isobars which are drawn at 2- or 3-millimeter intervals.

THE SPECIFIC GRAVITY OF SNOW.

By M. E. J. GHEURY, F. R. A. S. Dated Eltham, England, March 4, 1909.

The following determinations of the specific gravity of snow were made at Eltham, England, during the winter of 1908-9. The samples for weighing were collected, usually in duplicate sometimes in larger numbers, from different parts of a flat roof by cutting out rectangular blocks of definite dimensions. These blocks were then weighed and the specific gravity computed. Some earlier determinations of the specific gravity of snow, will be found in the MONTHLY WEATHER REVIEW for December, 1907.[1]

[1]M. E. J. Gheury: The specific gravity of snow. Monthly Weather Review, 1907, 35:583.

December, 1908.

December 27. Minimum −0.1°C., maximum 0.6°C. It snowed all day until late at night.

December 28. Minimum −4.2°C., maximum −1.4°C.

The snow was lying on the ground, being formed of light feathery star crystals; it could be considerably reduced in volume by pressure and then adhered firmly together. Depth, about 2 inches.

Two pieces were cut from over a flat roof.

	1st Piece.	2d Piece.
Volume..................	4,570 cm^3.	4,570 cm^3.
Weight..................	196.5 gm.	211.4 gm.
Specific gravity...........	0.0430	0.0462

Specific gravity, average, 0.0446, say 0.045.

December 29. Minimum −4.7°C., maximum −3.9°C. It snowed all day until nightfall, with a strong driving wind. In the evening, two new pieces were cut from a part of the flat roof which had been cleared from the snow of the 27th. The snow was formed of very minute compact crystals, undergoing considerable reduction of volume under pressure and then adhering firmly together. Depth, about $3\frac{1}{8}$ inches.

	3d Piece.	4th Piece.
Volume..................	1,844 cm^3.	1,844 cm^3.
Weight..................	162.0 gm.	158.0 gm.
Specific gravity...........	0.0878	0.0856

Specific gravity, average, 0.0867, say 0.087.

This specific gravity is almost double that of the snow which fell in the 27th.

December 30. Minimum −8.3°C. The temperature remained below zero throughout the day, but rising gradually and passing by zero in the early morning of December 31. A little snow fell during the night, formed of small crystalline grains that could not be made to adhere together under pressure being very mobile upon one another somewhat like dry sand. Depth, about $\frac{1}{2}$ inch.

Two pieces of this fresh snow were cut from a part of the flat roof cleared from the snow of the 27th and 29th.

	5th Piece.	6th Piece.
Volume..................	1,303 cm^3.	590 cm^3
Weight..................	129.4 gm.	60.7 gm.
Specific gravity..........	0.0993	0.1029.

Specific gravity, average, 0.1011, say, 0.100.

It was then wished to investigate the effect of freezing on the fallen snow, and of the pressure of the fresh snow layers upon the old ones. For this purpose two pieces were cut from a part of the flat roof that had been left undisturbed, and the snow of which therefore consisted of three successive layers from the 27th, 29th, and night of 29th–30th. The total thickness was $3\frac{6}{8}$ inches as against $5\frac{5}{8}$ inches which was the sum of the individual falls.

	7th Piece.	8th Piece.
Volume..................	2,120 cm^3.	2,120 cm^3.
Weight..................	227.0 gm.	216.9 gm.
Specific gravity..........	0.1071	0.1023

Specific gravity, average, 0.1047, say, 0.105.

Two pieces were also cut from a part of the flat roof cleared on the 28th from all snow fallen on the 27th, the snow lying on that part thus consisting of the last two snowfalls only. Thickness, $3\frac{4}{8}$ inches (against $3\frac{5}{8}$ inches, the sum of the individual layers).

	9th Piece.	10th Piece.
Volume..................	2,143 cm^3.	2,143 cm^3.
Weight..................	211.7 gm.	208.6 gm.
Specific gravity...........	0.0988	0.0974

Specific gravity, average, 0.0981, say 0.098.

Reduction in thickness of second layer $= (3\frac{1}{8} + \frac{4}{8}) - 3\frac{4}{8} = \frac{1}{8}$ inch, that is $\frac{1}{8}$ out of $3\frac{1}{8}$ or $\frac{1}{25}$ of its former value. The volume being reduced to $\frac{24}{25}$ of its former value the specific gravity will have increased through this cause to $\frac{25}{24}$ of its former value and become $\frac{25}{24} \times 0.087 = 0.0906$. In the two layers, for a thickness of $3\frac{4}{8}$ inches, we have then 3 inches at 0.0906 and $\frac{4}{8}$ inch at 0.1011. The resulting specific gravity is 0.092 and it was found to be 0.098. Making allowance for the errors inherent to this kind of measurement, we can say that the whole of the increase in specific gravity seems due to compression caused by the weight of subsequent layers, the the action of the frost on the lying snow being very small unless, of course, it partially melts and recongeals.

Reduction of thickness of first layer $= (2 + 3\frac{4}{8}) - 3\frac{6}{8} = 1\frac{6}{8}$ inches. That is $1\frac{6}{8}$ out of 2 inches or $\frac{1}{8}$ of its former value. The volume being reduced to $\frac{1}{8}$ of its former value, the specific gravity will have increased through this cause to eight times its former value and becomes $8 \times 0.0446 = 0.3568$, say 0.357.

Two-eighths inch at 0.357 and $3\frac{4}{8}$ inches at 0.098 give a resultant specific gravity of 0.115. This agrees fairly well with 0.105, the value found for the three layers taken together, when we remember that 0.0446 is the mean of two determinations that were not in satisfactory agreement and that the error is being multiplied by 8, and the result found 0.357 may be affected by a serious error.

December 31. There was a gradual rise of temperature during the night. The thaw began. Maximum 6.8°C.

February, 1909.

February 26. Minimum −0.9°C., maximum 2.3°C. On this date and the 27th (minimum −1.7°C., maximum 1.7°C.), some powdery snow fell and lay on the ground. Early on February 27 very light thick flakes fell for sometime. After this the snow on the ground was found to consist of two layers of equal thickness, the lower one formed of round grains about 1 millimeter in diameter closely packed, the upper one of fine light fluffy spicules of ice. Blowing on the surface of the snow was sufficient to remove this upper layer, leaving the lower one undisturbed. Two pieces $\frac{7}{8}$ inch in thickness were cut on each side of a flat roof.

	1st Piece.	2d Piece.
Volume..................	2,066 cm^3.	2,066 cm^3.
Weight..................	186.2 gm.	190.6 gm.
Specific gravity..........	0.0901	0.0923

Specific gravity, average, 0.0912, say 0.091.

On the other side of the roof the snow was only $\frac{6}{8}$ inch deep.

	3d Piece.	4th Piece.
Volume..................	1,900 cm^3.	1,771 cm^3.
Weight..................	193.4 gm.	171.5 gm.
Specific gravity...........	0.0936	0.0968

Specific gravity, average, 0.0952, say 0.095.

The lower layer was found wet, as if it had begun to thaw slightly, this accounts for the increase in specific gravity.

The upper layer was then carefully blown away and snow belonging to the lower layer was collected. Its thickness was $\frac{7}{16}$ inch and it consisted of round grains, closely packed.

	5th Piece.	6th Piece.
Volume..................	951 cm^3.	951 cm^3.
Weight..................	163.8 gm.	157.9 gm.
Specific gravity...........	0.1660	0.1720

Specific gravity, average, 0.169, say 0.170.

On the other side, where the snow had slightly thawed it was $\frac{3}{8}$ inch in thickness.

	7th Piece.	8th Piece.
Volume..................	733 cm^3.	799 cm^3.
Weight..................	129.3 gm.	141.8 gm.
Specific gravity..........	0.176	0.178

Specific gravity, average, 0.177.

From these measures the specific gravity of the upper layer (removed by blowing) is easily obtained, the thickness of each layer being in both cases half the total thickness.

If x is the specific gravity of the upper layer; y the specific gravity of the lower layer; g the specific gravity of both layers together; $2v$ the total volume per unit area, then $vx+vy=2vg$, or $x+y=2g$ and $x=2g-y$. On one side of the roof $x=2\times 0.091-0.169=0.013$. On the other side of the roof $x=2\times 0.095-0.177=0.013$. The measures are thus in very good agreement throughout.

March, 1909.

March 1. Minimum $-2.2°C.$, maximum $1.5°C.$ During the night snow fell abundantly, and this continued during part of the morning, when a layer of firm crackling snow covered the ground to a depth of about $2\frac{5}{8}$ inches. The snow was very compact and adherent undergoing little diminution of volume under pressure and reducing to a hard, solid mass. Special care was taken in cutting the pieces.

	1st Piece.	2d Piece.	3d Piece.
Volume.........	2,644.5 cm^3.	2,809 cm^3.	2,798 cm^3.
Weight..........	168.8 gm.	172.8 gm.	164.4 gm.
Specific gravity.	0.0638	0.0616	0.0587

Specific gravity, average, 0.0614, say 0.061, with a maximum error of $4\frac{1}{2}$ per cent.

March 2–3. After a very cold night (minimum $-6.1°C.$) it thawed slightly (maximum $2.8°C.$) and the wind became southerly, but at night more snow fell, and on the morning of March 3 (minimum $-1.3°C.$) everything was again covered with a layer, $2\frac{5}{8}$ inches thick, of snow formed of small grains closely packed, adhering firmly together under pressure with a fair reduction in volume.

The ordinary method of securing a block of snow from the roof failed owing to the fact that the snow adhered to the tools so that small parts of the block always remained on the tools.

A tin box was therefore used, being laid squarely on the flat roof, bottom uppermost, the surrounding snow being then cleared and the imprisoned snow collected.

	Volume.	Weight.	Specific gravity.
1st Piece.........	1,618 cm^3.	106.65 gm.	0.0659
2d Piece..........	1,618 cm^3.	132.70 gm.	0.0819
3d Piece..........	1,618 cm^3.	109.30 gm.	0.0675
4th Piece.........	1,618 cm^3.	128.55 gm.	0.0795
Mean..			0.0737

Specific gravity 0.074, with a maximum error of 11 per cent. This method does not seem as accurate as the method of cutting rectangular blocks.

Remark. The least specific gravity found was 0.013 for very light fluffy spicules of ice. The greatest specific gravity found (excluding the cases where the ice had begun melting) was 0.169, for closely packed round grains about 1 millimeter in diameter.

WEATHER BUREAU MEN AS EDUCATORS.

S. S. Bassler, Local Forecaster, Cincinnati, Ohio, read a paper on the Weather Bureau and its work, on March 16 before the Hyde Park Business Men's Club.

M. E. Blystone, Local Forecaster, Providence, R. I., lectured on the Weather Burean and its work on March 9 and 30 before the Men's Club of two local churches.

George M. Chappel, Section Director, Des Moines, Iowa, reports that on March 25 he gave a lecture on the work and usefulness of the Weather Bureau, before students of the Iowa State College, Ames, Iowa; on March 24 students from the High School at Valley Junction, Iowa, visited the Local Office at Des Moines.

C. H. Eshleman, Observer, Grand Haven, Mich., reports that students from the Ottawa County Normal School visited the Grand Haven office on March 18 and 19, when he gave an hour's instruction on the development and movements of storms, and on the work of the Weather Bureau.

W. D. Fuller, Observer, Los Angeles, Cal., reports that the local office was visited on March 8 by a class from the State Normal School; and on the 10th by a class from the Yale School for boys.

R. T. Lindley, Observer, Asheville, N. C., reports an increasing interest, on the part of the local public, in the work of the Weather Bureau. He also reports that he has been asked to give daily instructions at the Biltmore Forestry School, Dr. C. A. Schenck, director. Recently the members of this school visited the Asheville office; as did also the class in physical geography from a local private school.

A. G. McAdie, Professor and District Forecaster, San Francisco, Cal., reports that on March 31 he delivered a lecture at Mount Tamalpais before 200 members of the Public School Teachers' Institute of Marin County.

Eric R. Miller, Local Forecaster, Madison, Wis., reports that on March 12 he addressed the Engineering Society and Club of the University of Wisconsin, on "The relation of the U. S. Weather Bureau to the engineer." On the 17th he addressed the class in hydrology, speaking on the scope of meteorology and climatology.

A. H. Thiessen, Section Director, Raleigh, N. C., reports that on March 8 his office was visited by a class in physics from the local Baptist University (for women). He also reports that the authorities of the State Agricultural and Mechanical College have granted him $25 for the purchase of lantern slides needed in his course to seniors in agriculture and others.

W. W. Thomas, Assistant Observer, Lewiston, Idaho, gave an informal talk on the work of the Weather Bureau, to students of the Lewiston State Normal School on March 24. After the talk his audience visited the local office where the workings of the service were explained and illustrated.—*C. A., jr.*

CHANGES IN THE MONTHLY WEATHER REVIEW.

The following are the latest orders concerning the changes in the MONTHLY WEATHER REVIEW.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., April 12, 1909.

1. With the view to better meeting the requirements of the public services under control of the United States Weather Bureau and the associated bureaus named in Instructions No. 76, 1908, the system of compiling and publishing meteorological data by the Weather Bureau is hereby modified so that, beginning with July 1, 1909, such data will be grouped according to natural topographic districts and published in a consolidated and unified form.

2. For this purpose the United States has been divided into twelve climatological districts conforming to its twelve principal drainage areas, outlined on the accompanying map (Chart IX). This scheme of division has been adopted as affording the best system of territorial units for the compilation and discussion of climatological data and has been agreed to by the associated bureaus. For these reasons the districts adopted will be adhered to as far as practicable in matters of administration, in the publication of correlated observations, and in the distribution of meteorological data, especially as affecting agriculture, transportation, irrigation, forestry, and engineering. In these lines of work each large district will be under the supervision of a selected division director, but in the supervision of substations and in the collection of observations section directors will continue their present duties within their respective States.

3. The publication of the monthly section reports of the climatological service, except those for Iowa, Porto Rico, and Hawaii, will be discontinued with the issue for June, 1909.

4. Beginning with the issue for July, 1909, the Monthly Weather Review will be devoted exclusively to the publication and discussion of climatological, river, and forecast data. Special articles of a scientific nature, but not strictly climatological, will be published in the Bulletin of the Mount Weather Observatory or in separate form. The editing of the Review will be under the general supervision of the Chief of the Climatological Division, in collaboration with the twelve directors in charge of the climatological districts, who will be designated division editors. The Review will contain twelve sections de-